GREAT LAKES INDIAN FISH AND WILDLIFE COMMISSION
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Via Electronic Mail

June 1, 2018

Technical Memorandum

To: Nancy Schuldt, Water Projects Coordinator, Fond du Lac Environmental Program

From: John Coleman, GLIFWC Environmental Section Leader

Re: Overwinter water quality in Sandy River near Minntac Tailings Basin

The purpose of this memorandum is to report on monitoring of water quality during the winter of 2017-2018 in the Sandy River, upstream of the Twin Lakes.

Methodology:

On August 9th of 2017, Environmental Section staff traveled on foot and by canoe up the Sandy River to a location approximately 1/4 mile upstream of the Twin Lakes, between the Twin Lakes and Admiral Lake. Field parameters were measured with a YSI ProDSS meter. Prior to the site visit the YSI was calibrated to standards for specific conductance, pH, chloride, dissolved oxygen, temperature and depth. Time was synchronized with GPS satellites and sample locations were recorded with the YSI ProDSS internal GPS sensor and with a hand-held GPS receiver. During the site visit a Hobo U24-001 data logger was installed in the current, approximately 10 inches above the river bottom. River water depth at the time of installation was 24 inches. The logger was set to record conductivity and temperature at 30 minute intervals. At the time of logger installation, specific conductance and water temperature were measured in the river with the YSI ProsDSS approximately 20 feet downstream. Grab sample and field measurements from the site visit were reported in our previous memo dated January 25th, 2018.

On May 10th of 2018, Environmental Section staff traveled by foot to retrieve and download the Hobo data logger. At that time, temperature and specific conductance was again measured with a YSI-ProDSS. River water depth was measured as 38 inches. After download of the U24-001, conductivity values were converted to specific conductance (conductivity @ 25 degC) using the formula [specific conductance = conductivity / (1+ 0.019*(temperature-25))]. This is the same formula used by the YSI-ProDSS to convert conductivity to specific conductance. Measurements from the YSI-ProDSS and the Hobo U24-001 during installation and retrieval were compared (Table 1) and specific conductance was found to be within 2% and temperature was found to be within 4% (within 2% after the U24-001 had stabilized for 3 hours, Table 1).

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Table 1. Readings of specific conductance and temperature at times of logger placement and retrieval.

Date	YSI-ProDSS		Onset-Hobo U24-001	
	Specific Cond. (uS/cm)	**Temperature** (C)	**Specific Cond.** (uS/cm)	**Temperature** (C)
2017-08-09	1614	20.6	1590	21.5 (21.0 after 3 hours)
2018-05-10	558	6.0	567	5.9

Results:

The Hobo U24-001 logger values indicate that between August 9th, 2017 and May 10th, 2018 Sandy River water temperature ranged from a high of 22.1 down to 0.2 ºC, conductivity ranged from 1,623 to 217 uS/cm and specific conductance ranged from 2,147 to 395 uS/cm (Figure 1).

Specific conductance fell from 1,750 uS/cm on August 16th to 710 uS/cm on the 17th after 3.6 inches of rain fell in nearby Virginia, MN on the 16th and 17th. Specific conductance rose in the fall until by December 28th it had reached 1,800 uS/cm. It remained above 1,800 uS/cm for 91 days, until March 28th, 2018 when it was declining with spring snow and ice melting. The highest specific conductance readings were in mid-February at 2,145 uS/cm (Figure 1). During spring thaw, specific conductance fell to a low of 395 uS/cm due to dilution from melting snow and ice.

Specific conductance of the Sandy River was very responsive to spring ice-out and precipitation events during the non-frozen seasons. Two large storms, one on August 16-17th and the other on October 2nd were recorded by U.S. Steel at the Minntac Tailings Basin weather station (NTS, 2017). Those precipitation events are reflected in the specific conductance record (Figure 1) as drops in specific conductance of 1,050 uS/cm in August and 282 uS/cm in October. Spring ice-out began in late March and caused a drop of approximately 1,500 uS/cm in specific conductance by late April (Figure 1).

Discussion:

As noted in our technical memo of January 25, 2018 (GLIFWC, 2018), in recent years the specific conductance in the Twin lakes has been observed, by the 1854 Treaty Authority (1854 Treaty Authority, 2018) and U.S. Steel's consultant Northeast Technical Services (NTS, 2016 and NTS, 2017), to fluctuate substantially. Water quality observations are recorded annually in the 5 months between late-May and late-October by those two entities. There are few if any wintertime readings or water samples from the Sandy River at or upstream of the Twin Lakes. There are monthly readings in the Sandy River for flow and sulfate approximately two miles downstream of the Twin Lakes (site SW001 also called site 701, Figure 2). Given the exceedances and near exceedances of multiple water quality parameters documented at SW001 (site 701) in technical documents for the 2004 Minntac EIS (MWH 2004), and the higher concentrations consistently observed in the Twin Lakes and upper Sandy River, it appears that additional information on Twin Lakes water quality during winter is warranted.

The water quality data we collected over the winter of 2017-18 shows that specific conductance is substantially higher during the 3 months of January, February, and March than during other times of the year. During mid-winter there are no precipitation inputs to dilute the tailings basin water that enters the Sandy River. During that 3 month winter period, specific conductance in the Sandy River upstream

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of the Twin Lakes ranged from 1,800 to 2,147 uS/cm with a average of 2,017 uS/cm. This compares to an average found in the summer by NTS in 2017 of 1,228 uS/cm in the Sandy River where it flows into the Twin Lakes (NTS, 2017, Table 1).

The water specific conductance we recorded in the Sandy River in 3 months of mid-winter (average of 2,017 uS/cm) is very similar to specific conductance found in groundwater monitoring well GW003 (Figure 2). This well is just outside the berm on the east side of the basin and was measured during 2015 (MN-PCA 2016, Table 7). Those readings of specific conductance in groundwater ranged from 2,075 to 2,109 uS/cm. Our mid-winter readings are also very similar to measurements taken during an EPA September 2017 site inspection which found specific conductance to be 2,316 to 2,509 uS/cm at the toe of the berm, inside the seep capture system (USEPA, 2018).

Conclusions:

1) The consistent high level of specific conductance in the Sandy River during mid-winter suggest that water quality entering the Twin Lakes from the Minntac Tailings basin during at least 3 months of winter is substantially poorer that that measured during the rest of the year. The winter appears to be a period during which pollutant concentrations entering the Twin lakes are much higher than during the ice-free period, yet there is little water quality data from winter. Evaluations of impacts of water quality on the Sandy River, Admiral Lake, and the Twin Lakes must consider winter pollutant concentrations.

2) Based on specific conductance readings, the character of the water in the Sandy River entering the Twin Lakes during mid-winter appears to be nearly identical to the water at the toe of the tailings basin near seep SD002 (Figure 2). It appears that during the 3 months of January through March 2018 the Sandy River contained almost purely tailings basin water. The direct hydrologic connection between the tailings basin, the Sandy River, Admiral Lake, and the Twin Lakes, particularly during winter, must be considered when setting permit limits for the Minntac project.

If you have any questions about this memo, please contact me at 608-263-2873 or jcoleman@glifwc.org.

cc: Jonathan Gilbert, Director, GLIFWC Biological Services Division
Ann McCammon Soltis, Director, GLIFWC Division of Intergovernmental Affairs
Krista McKim USEPA, NPDES Programs Branch

References

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Figures

Figure 1. Temperature, conductivity and specific conductance recorded in the Sandy River, upstream of the Twin Lakes, August 9, 2017 through May 10, 2018.

Figure 2. Map of groundwater and surface water sample sites referenced in this technical memorandum.

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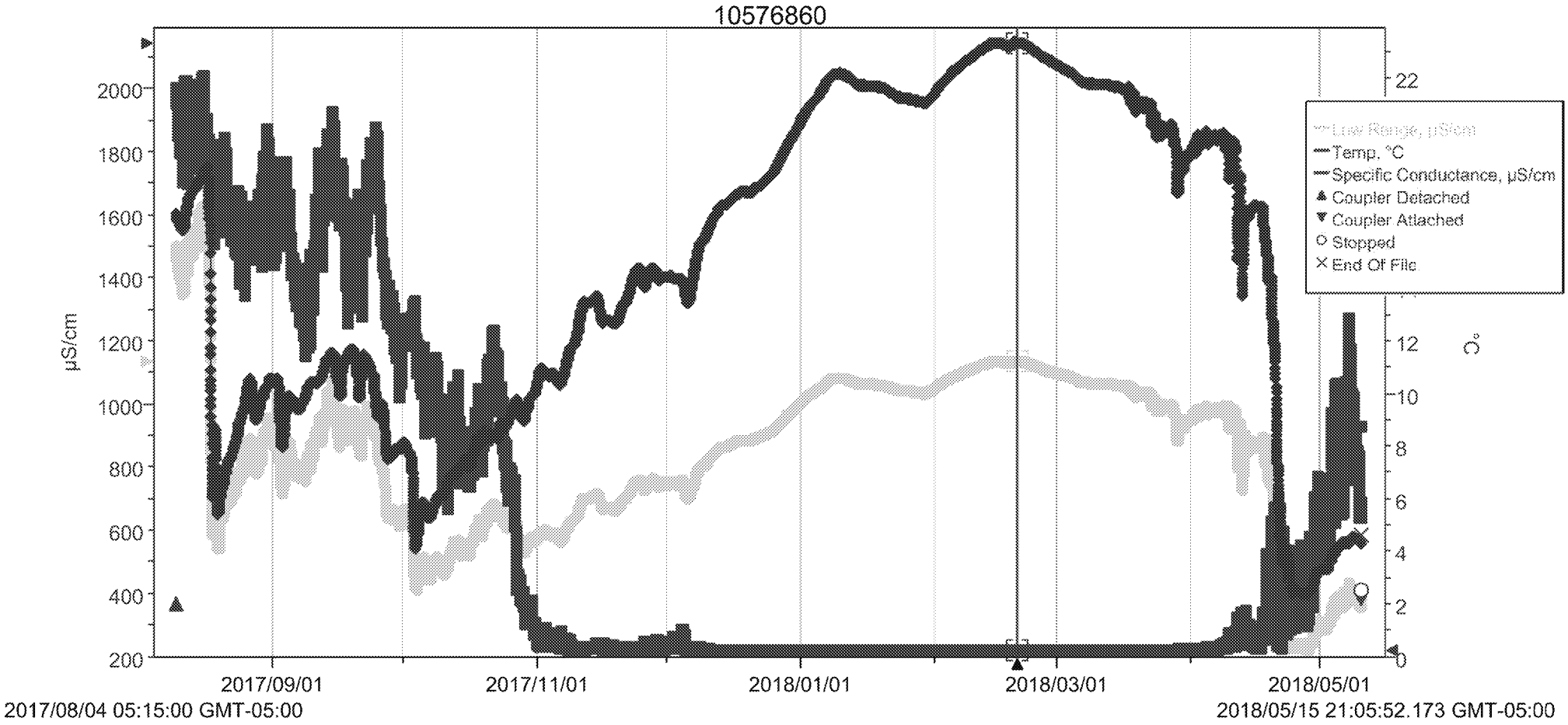

Figure 1. Temperature, Conductivity, and Specific Conductance (conductivity @ 25C) at the Sandy River, 0.2 miles upstream of the Twin Lakes.

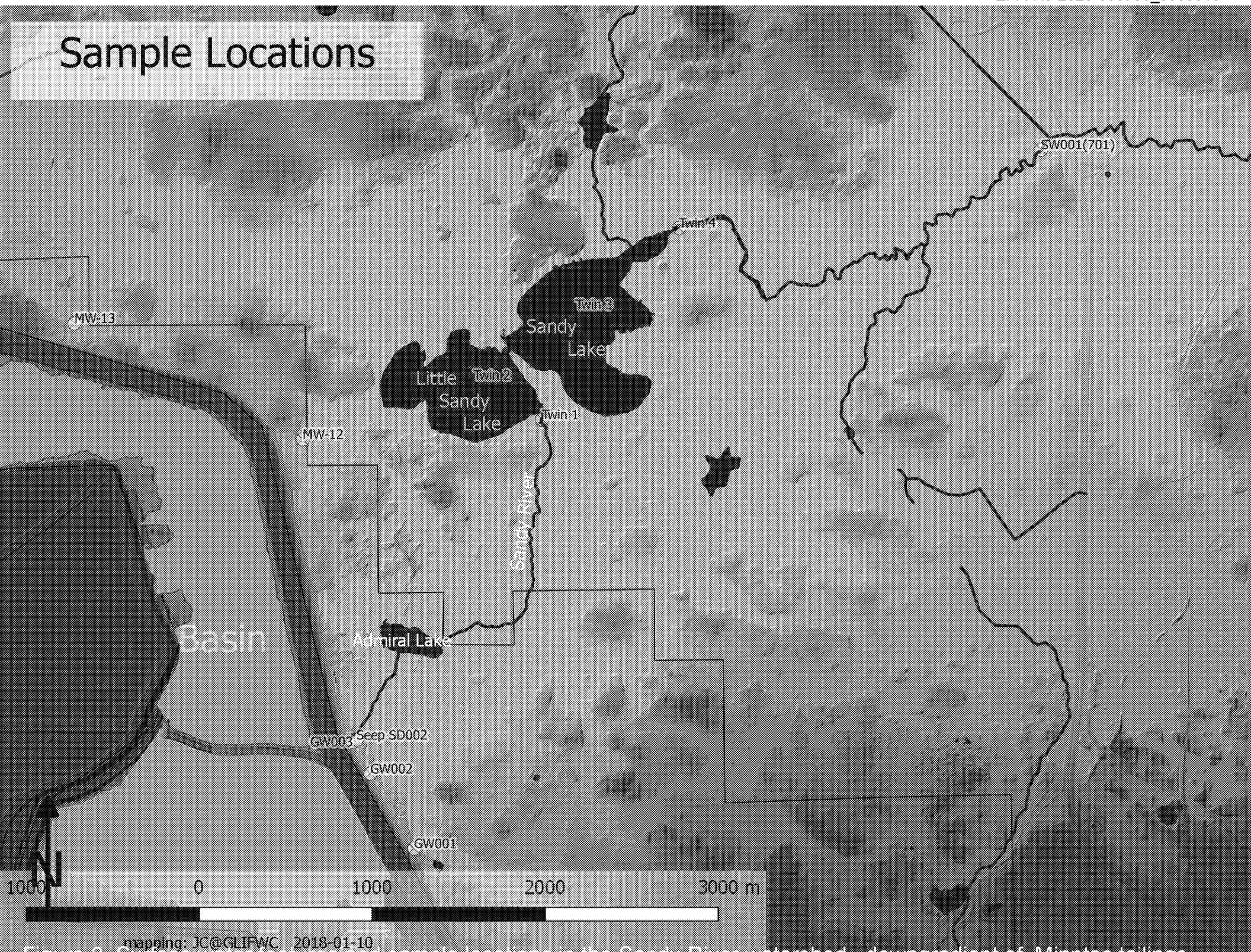

Figure 2. Surface water features and sample locations in the Sandy River watershed, downgradient of Minntac tailings.